

**Japanese Unexamined Patent Publication  
No. 335187/1999 (Tokukaihei 11-335187)**

**A. Relevance of the Above-identified Document**

The following is a partial English translation of exemplary portions of non-English language information that may be relevant to the present invention.

**B. Translation of the Relevant Passages of the Document**

See also the attached English Abstract.

**[CLAIMS]**

1. A photocatalyst module, in which a photocatalyst is supported by a surface of a base material made up of a ceramic porous body having through holes and having a porosity of 75 % to 95 %.

2. The photocatalyst module as set forth in claim 1, wherein:

a platinum group, gold, or an alloy of these metals and a transition metal is supported by the surface of the base material.

3. The photocatalyst module as set forth in claim 1 or 2, wherein:

the base material is a baked member made of at least one compound selected from a group consisting of

aluminum oxide, zirconium oxide, silicon oxide, magnesium oxide, and titanium oxide.

4. A photocatalyst apparatus, comprising:

a container main body, which has a flat plate-like shape;

a flat plate-like photocatalyst module, which is obtained by processing the photocatalyst module as set forth in any one of claims 1 through 3 such that the photocatalyst module has a flat plate-like shape, and which has a light receiving surface and a light transmitting surface, and which is retained in the container main body; and

means, which is provided adjacent to the light emitting surface of the flat plate-like photocatalyst module so as to reflect and diffuse light.

5. A photocatalyst apparatus, comprising:

a container main body, which has a cylindrical shape;

a cylindrical photocatalyst module, which is obtained by processing the photocatalyst module as set forth in any one of claims 1 through 3 such that the photocatalyst module has a cylindrical shape, and which has a light receiving surface and a light transmitting surface, and which is retained in the container main body;

lighting means, which is so provided as to be capable of irradiating light to the cylindrical photocatalyst module; and

means, which is provided adjacent to the light emitting surface of the flat plate-like photocatalyst module so as to reflect and diffuse the light.

6. The photocatalyst apparatus as set forth in claim 4 or 5, wherein:

the means provided to reflect and diffuse the light is a plate-like member made of a metal.

#### [EMBODIMENTS]

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##### [0039] Embodiment 1

Fig. 1 is an enlarged view illustrating a part of a photocatalyst module in which fine particles of a photocatalyst are supported by a surface of a ceramic porous body according to the present invention.

##### [0040]

As shown in Fig. 1, the ceramic porous body is a structure including a fibrous skeleton 1 which has a series of through holes formed in three dimensions, and which supports the ceramic porous body. The ceramic porous body has a porosity of 85 %. Each of the through holes has a unit cell 2 whose diameter falls within a range

from approximately 1 mm to approximately 5 mm.

[0041]

Fig. 2 is an enlarged cross sectional view illustrating the photocatalyst module. The fibrous skeleton 1 has a surface by which titanium dioxide fine particles 3 each serving as an active photocatalyst are supported. Each of the titanium dioxide fine particles 3 is a crystalline particle having a diameter of 1 nm through 100 nm.

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[0057] Embodiment 3

Fig. 4 illustrates an exterior of a purifying apparatus according to Embodiment 3. Such a purifying apparatus 5 is a photocatalyst apparatus using the photocatalyst module of Embodiment 2, and purifies water by using either natural light or artificial light having a wavelength falling within a range from 360 nm to 400 nm.

[0058]

The purifying apparatus 5 has a container 6 having a thin plate-like shape. The container 6 has an upper surface made of quartz hard glass, and has side surfaces and a bottom surface, each of which is made of a corrosion-resistant metal such as stainless steel.

[0059]

As shown in Fig. 4, an inlet 7 and an outlet 8 are provided in side surfaces facing each other.

[0060]

Fig. 5 is a cross sectional view illustrating a part of the container 6.

[0061]

The container 6 has an inside in which the photocatalyst module 9 having a thin plate-like shape is retained. Further, the photocatalyst module 9 is wholly surrounded by quartz hard glasses. Specifically, the upper surface of the photocatalyst module is covered by a quartz hard glass 10A. Moreover, each of the side surfaces and the bottom surface thereof makes contact with a metal plate 11 of the container 6, with a quartz hard glass 10B therebetween.

[0062]

The photocatalyst module 9 is obtained by processing a photocatalyst module identical to that of Embodiment 2 so that the photocatalyst module has a flat plate shape having (i) a longitudinal length of 1m, (ii) a lateral length of 1m, and (iii) a height of 0.05 m.

[0063]

It is preferable to use, as the quartz hard glasses 10A and 10B, quartz hard glasses which do not absorb the natural light and the artificial light having a wavelength of 360 nm to 400 nm as much as possible. This is because energy required for activation of the titanium dioxide of the photocatalyst module 9 is efficiently supplied. Apart from each of such quartz hard glasses, it is preferable to

use a high silica glass, a borosilicic acid glass, or the like. Moreover, a normal soda lime glass can be used.

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[0073] Embodiment 4

Fig. 8 illustrates an exterior of a purifying apparatus according to Embodiment 4. As is the case of the purifying apparatus of Embodiment 3, such a purifying apparatus 5 is a photocatalyst apparatus using the photocatalyst module of Embodiment 2, and purifies water by using either natural light or artificial light having a wavelength falling within a range from 360 nm to 400 nm.

[0074]

In the present embodiment, the container 6 has a cylindrical shape, and is made of a corrosion-resistant metal such as stainless steel. The container 6 has an upper surface and a bottom surface in which conducting units 13 are provided, respectively.

[0075]

As shown in Fig. 8, an inlet 7 and outlet 8 are respectively formed in the vicinity of an upper end and a bottom end of a circumferential surface of the container 6 so as to be opposite to each other.

[0076]

Fig. 9 is a cross sectional view illustrating the purifying apparatus 5.

[0077] As shown in Fig. 9, the container 6 has an

inside in which the photocatalyst module 9 is retained. The photocatalyst module 9 is obtained by processing a photocatalyst module identical to that of Embodiment 2 so that the photocatalyst module has a cylindrical shape having (i) an outer diameter of 0.2 m, (ii) an inner diameter of 0.05m, and (iii) a height of 1m. Moreover, the photocatalyst module 9 has a through hole in its center.

[0078]

Further, the photocatalyst module 9 is wholly surrounded by a quartz hard glass. Specifically, each of the upper surface, the side surface, and the bottom surface of the photocatalyst module 9 makes contact with a metal plate 11 of the container 6, with a quartz hard glass 10B therebetween. Further, a light emitting diode 12 is provided, as an artificial light source, in the through hole of the photocatalyst module 9 with a quartz hard glass 10A provided between the light emitting diode 12 and the photocatalyst module 9.

[0079]

The light emitting diode 12 is connected to the conducting units 13. When electricity is supplied from the conducting units 13 to the light emitting diode 12, the light emitting diode 12 emits a light beam having a wavelength falling within a range from 360 nm to 400 nm. In cases where titanium dioxide is used as the photocatalyst as is the case with the present embodiment,

it is preferable to irradiate artificial light having high spectrum strength in a wavelength range of 380 nm to 390 nm. This is because titanium oxide has a peak of a light absorption spectrum in this wavelength range.

[0080]

Note that one conducting unit 13 may be provided on either the upper surface or the bottom surface of the container 6, as shown in Fig. 10. In this case, the hole formed in the central portion of the photocatalyst module 9 does not need to be a through hole.

[0081]

Further, as shown in Fig. 11, spaces A and B may be formed on the inlet-side and the outlet-side of the photocatalyst module 9 retained in the container 6. Such a structure makes it possible that the same differential pressure is exerted on introduced water in any location of the photocatalyst module 9. Accordingly, the entire photocatalyst module 9 is effectively used. Further, a baffle plate may be formed in the container 6 so that the introduced water flows through the entire photocatalyst module 9.

[0082]

The purifying apparatus is arranged as described above. When the light emitting diode 12 receives electric power from the conducting unit 13, the light emitting diode 12 irradiates, to the photocatalyst module 9, light

having a wavelength falling within a range from 360 nm to 400 nm.

[0083]

The light irradiated to the photocatalyst module 9 via the quartz glass 10A excites the titanium dioxide supported by the ceramic porous body. The light passing through the quartz glass 10B is reflected and diffused by the metal plate 11, with the result that the light thus reflected and diffused re-enters the photocatalyst module 9.

[0084]

The titanium dioxide thus excited allows photocatalyst reaction on the water introduced from the inlet 7 to the photocatalyst module 9. This oxidizes and resolves funguses, bacteria, organic chlorine compounds such as trihalomethane, and causative agents for smelling of chlorine, each of which exists in the water. The water thus purified is discharged from the outlet 8.

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(54) 【発明の名称】 光触媒モジュール及び光触媒装置

(57) 【要約】

【課題】 広い触媒面積と高い触媒活性を有し、高い光到達性と優れた耐食性を示す、光触媒効率の高い光触媒モジュールとこうした光触媒モジュールを使用した光触媒装置を提供すること。

【解決手段】 気孔率75%～95%の連通孔を有するセラミック多孔体からなる基体の表面に光触媒が担持されており、この基体の表面に、白金族、金、または、これらの金属と遷移元素との合金が、さらに担持されている光触媒モジュールと、この光触媒モジュールを使用した光触媒装置。

